

**DESIGN TECHNOLOGY
 STANDARD LEVEL
 PAPER 3**

Tuesday 19 November 2002 (morning)

1 hour 15 minutes

Name

Number

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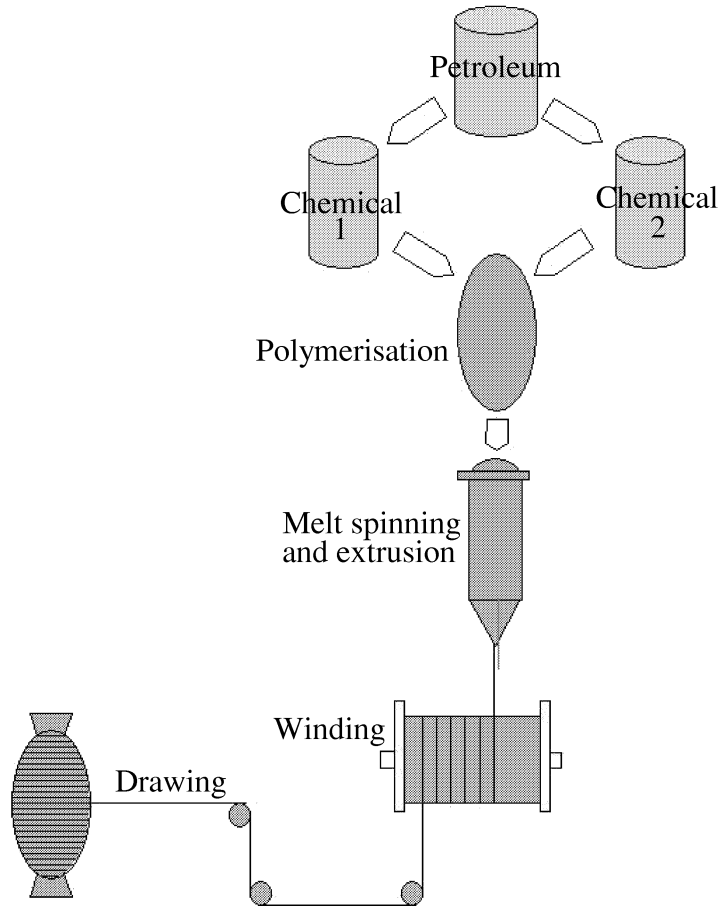
INSTRUCTIONS TO CANDIDATES

- Write your candidate name and number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from three of the Options in the spaces provided. You may continue your answers in a continuation answer booklet, and indicate the number of booklets used in the box below. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.
- At the end of the examination, indicate the letters of the Options answered in the boxes below.

OPTIONS ANSWERED	EXAMINER	TEAM LEADER	IBCA
	/15	/15	/15
	/15	/15	/15
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NUMBER OF CONTINUATION BOOKLETS USED	TOTAL	TOTAL	TOTAL
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Option A – Raw material to final product

A1. The diagram below represents the manufacture of nylon from petroleum.



(a) List the two chemicals involved in the manufacture of nylon. [2]

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(b) Compare cotton and nylon threads in terms of absorbency and effect of temperature. [2]

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(c) Nylon threads are extruded using a range of die shapes and sizes. Outline the benefits of this. [2]

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A2. Outline why superconductors are manufactured from alloys.

[2]

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A3. In the manufacture of high quality decorative articles, *e.g.* lead crystal glass vases, scrap glass is generated from waste from manufacturing and is recycled. Explain why scrap glass is used in this way.

[3]

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A4. Garden furniture can be made from a range of raw materials, *e.g.* cast iron and timber. Explain how differences between cast iron and timber impact on manufacturing techniques. [4]

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Option B – Products in context

B1. The photograph below shows a large wind-powered generator unit. As energy generation from wind power has developed there has been a shift from designing larger units, such as the one shown, to smaller less powerful units.



(a) State the type of energy resource that wind power represents. [1]

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(b) Outline **one** disadvantage of using wind power. [2]

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(c) Outline **one** advantage of larger units over smaller units. [2]

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B2. The government of a country in a temperate climate is seeking to increase the proportion of renewable energy utilised. Outline the difficulty of matching the supply of solar energy to the demand for energy. [2]

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B3. (a) Define *intermediate technology*. [1]

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(b) Explain why the clockwork radio can be described as an example of alternative, intermediate and appropriate technology. [3]

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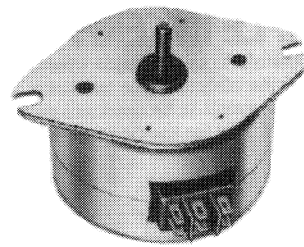
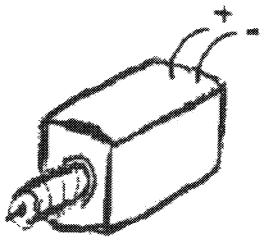
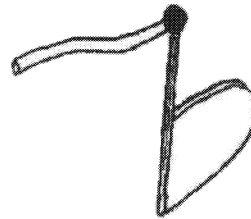
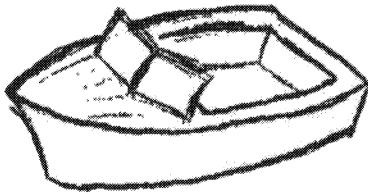
B4. In the design of a motor car, interior designers employ both performance tests and user trials to gain information. Outline the criteria for the selection of these two strategies in the design of named aspects of the motor car interior.

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Option C – Mechatronics

C1. The diagrams below show a model boat together with some components that can be used to steer the boat: a rudder; a solenoid; a stepper motor.



(a) Outline the function of a solenoid.

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(b) Draw and describe how the stepper motor can be connected to the rudder using gears.

[2]

(c) Compare the use of the solenoid with the stepper motor in controlling the direction of the boat.

[2]

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C2. Outline why critical damping is important in a position control servo system.

[2]

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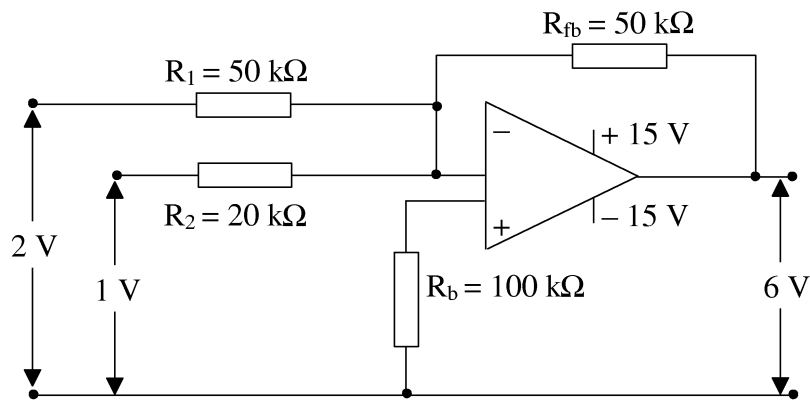
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C3. The circuit below was designed to produce an output voltage of 6 V with an input voltage of 2 V and 1 V. However, the actual output voltage was found to be incorrect and measured only - 4.5 V. Explain how the circuit could be modified to give the correct output.

[3]



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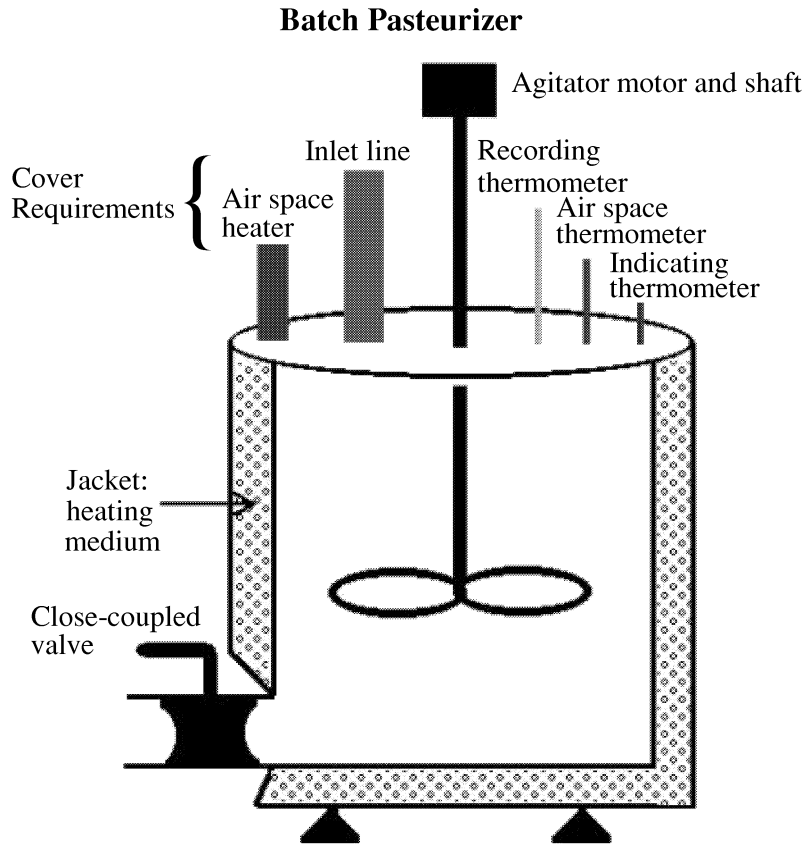
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Option D – Food technology

D1. Raw milk is often infected with disease-causing micro-organisms (pathogens), *e.g.* those causing tuberculosis. Such micro-organisms are heat-sensitive and, whilst they grow well at temperatures between 15 and 45 °C (the temperature danger zone), they are killed at higher temperatures. Raw milk can be pasteurized by heating to and maintaining at 63 °C for not less than 30 minutes in a batch pasteurizer or it can be heated to higher temperatures for much shorter periods of time, *e.g.* 72 °C for 15 seconds.



(a) State **one** additional benefit of pasteurizing raw milk, apart from killing pathogenic micro-organisms. [1]

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(b) Outline an alternative to batch processing for the pasteurization of the milk. [2]

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(This question continues on the following page)

(Question D1 continued)

- (c) Suggest why batch pasteurization uses 63 °C for 30 minutes rather than higher temperatures for much shorter times. [3]

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- D2.** Outline how **one** organoleptic property of a food is designed for a particular segment of the market. [2]

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- D3.** (a) Define *shortening*. [1]

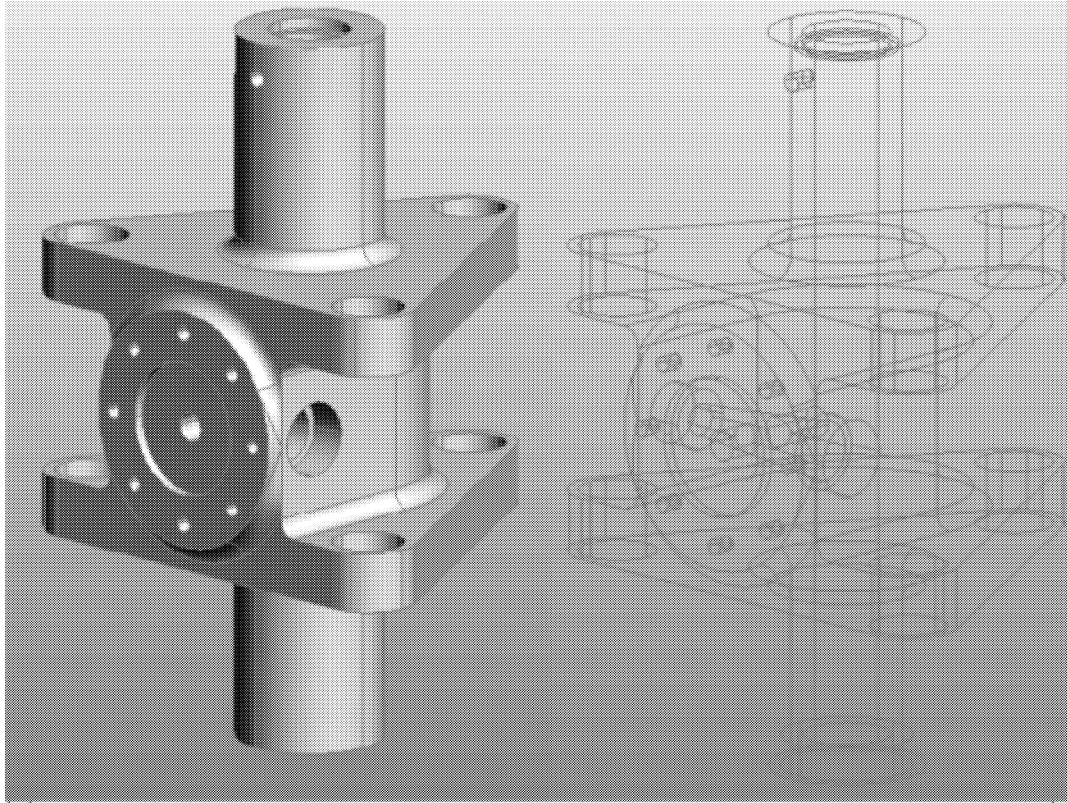
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- (b) Outline how shortening affects the physical properties of biscuits. [2]

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Option E – Computer aided design and manufacturing

E1. The photograph below shows a solid model and a wire frame model of a component.



(a) Define *wire frame modelling*. [1]

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(b) Outline how wire frame modelling helps communication between the designer and manufacturer. [2]

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(c) Discuss the order in which solid models and wire frame models are used by designers. [3]

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E2. Outline why NC has not become obsolete in certain applications, *e.g.* in the textile industry. [2]

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E3. (a) Define *Just-in-Case* (JIC). [1]

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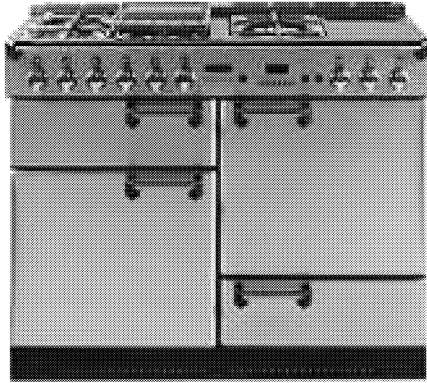
(b) Outline how JIC can help a manufacturer respond to rapid changes in demand. [2]

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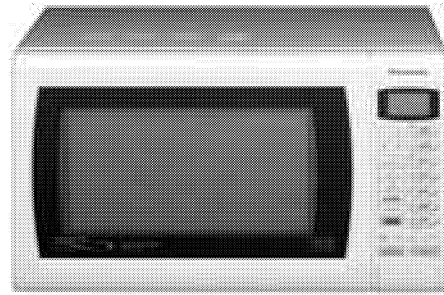
Option F – Invention, innovation and design

F1. The photographs below show two domestic ovens, A and B. Oven A is from a range of traditional style ovens that have essentially remained unchanged from a design perspective for almost 100 years. Oven B is a microwave. Oven A remains on and is never switched off contributing not only to cooking but also to space heating in the home.

Oven A



Oven B



(a) Identify lifestyle factors that favour the selection of Oven A. [2]

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(b) Oven B is designed with inbuilt obsolescence. Outline the advantages of obsolescence for the consumer. [2]

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(c) Outline why Oven A has not become obsolete. [2]

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F2. Identify **two** reasons why safety was a low priority for designers in the early stages of the development of the bicycle? [2]

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F3. Explain why re-innovation is an important element of the product cycle for many consumer products. [3]

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Option G – Health by design

G1. The photograph below shows a 41-day-old embryo. The photograph has been produced with the aid of Magnetic Resonance Imaging (MRI) techniques. MRI can be used to study the normal and abnormal development of an embryo in its mother’s womb.



[Source: <http://www.sciam.com/1999/0399issue/0399smithbox6.html>]

(a) State how electrical pulses are generated in MRI. [1]

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(b) Outline why MRI is superior to computer tomography (CT) scanning for studying the developing embryo. [2]

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(c) Explain **one** factor to be considered before installing MRI equipment in a hospital. [3]

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G2. (a) State **one** disadvantage of using a liquid-in-glass medical thermometer for measuring patients' temperatures. [1]

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(b) Outline the operation of a thermistor as a temperature measuring device. [2]

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G3. Describe how high refractive index glass has benefited spectacle wearers. [2]

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